(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/06190 A1

(51) International Patent Classification[7]: F26B 9/10

(21) International Application Number: PCT/GB00/02728

(22) International Filing Date: 20 July 2000 (20.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9916993.0 21 July 1999 (21.07.1999) GB

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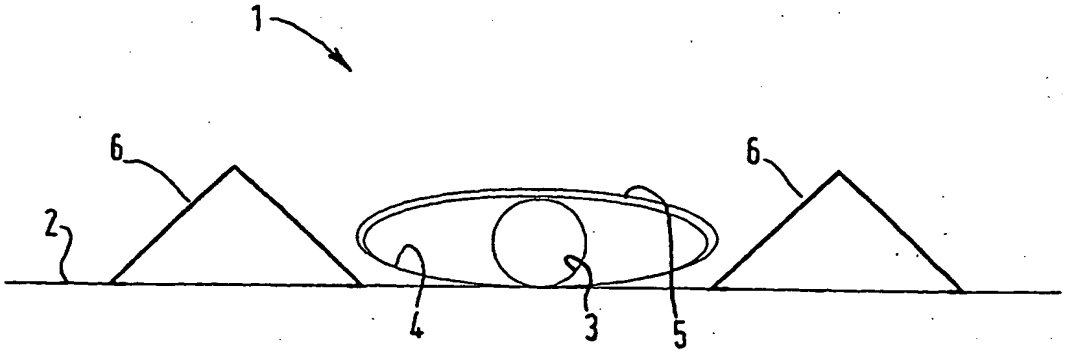
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND APPARATUS FOR TRANSPORTING A FLUID MEDIUM TO OR FROM A DISCRETE MASS SUPPORTED ON A FLOOR



(57) Abstract: A method and apparatus for transporting a fluid medium to or from a discrete mass supported on a floor (2), comprising arranging an inflatable pressure hose or pipe (3) under the discrete mass, arranging an inflatable fluid delivery hose or pipe (4) to lie adjacent to the inflatable pressure hose (3), inflating the pressure hose to form a cavity in the discrete mass such that the delivery hose is at least partly in the cavity and supplying fluid medium to the delivery hose whereby the fluid medium is introduced into the discrete mass, or alternatively evacuating fluid from the mass via the delivery hose.

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METHOD AND APPARATUS FOR TRANSPORTING A FLUID MEDIUM TO OR FROM A DISCRETE MASS SUPPORTED ON A FLOOR

DESCRIPTION

TECHNICAL FIELD

The invention relates to a method and means for transporting fluid, both in the sense of delivering fluid to and/or evacuating fluid from, a location. More particularly the invention is a method and means of delivering gas or liquid to and/or removing gas or liquid from a mass.

The invention is particularly concerned with the delivery of fluids into discrete materials that may not normally be free flowing, e.g. waste materials to be composted, but is also applicable to free flowing materials such as grain.

BACKGROUND ART

It is known to deliver gas, e.g. air, into a mass of material, e.g. compostable material, through rigid perforated pipes positioned on a solid, e.g. concrete, floor and over which the compostable material has been placed in a heap. Such rigid pipes are, however, vulnerable to damage by being run-over by heavy plant and equipment associated with such compost handling.

It is also known to dry grain in bulk with heated air supplied *via* ducts in a grain floor. Such grain floor duct arrangements are expensive and are not ideal for materials such as compostable material which is of variable consistency and which, particularly when wet may penetrate and block or flood the air ducts.

It is known from EP-A-835856 of THONI to ventilate a composting heap or store of agricultural produce (e.g. for grain drying) by laying the heap or store on a floor on a pre-positioned and pre-pressurised perforated hose linked to an air supply. After treatment the hose is allowed to collapse so as to be released from overhead pressure in the heap to facilitate removal of the hose from the heap.

DISCLOSURE OF INVENTION

According to the invention there is provided a method of transporting a fluid medium to or from a discrete mass supported on a floor, comprising arranging an inflatable pressure hose or pipe under the discrete mass, arranging an inflatable fluid delivery hose or pipe to lie adjacent to

the inflatable pressure hose, inflating the pressure hose to form a cavity in the discrete mass such that the delivery hose is at least partly in the cavity and supplying fluid medium to the delivery hose whereby the fluid medium is introduced into the discrete mass, or alternatively evacuating fluid from the mass *via* the delivery hose.

The pressure hose may be arranged on the floor. The pressure hose and the delivery hose may first be positioned on the floor in a deflated condition and the discrete mass placed on the hoses while they are deflated.

The pressure hose may be inflated to a high pressure e.g. of the order of 100 to 400kPa. The delivery hose may be inflated to a pressure in the range 100 to 400kPa. Where the material of the discrete mass is such that the cavity is self-sustaining, the pressure in the pressure hose may be released after creation of the cavity so that the pressure hose deflates. The fluid medium may be gaseous, e.g. air.

From another aspect the invention is apparatus supplying a fluid medium into, or removing fluid from, a discrete mass supported on a floor, comprising an inflatable pressure hose under or in the discrete mass, and an inflatable fluid delivery hose positioned adjacent to the inflatable pressure hose, the arrangement being such that the pressure hose can be inflated to create a cavity in the discrete mass and such that the fluid delivery hose can be inflated in the said cavity or is caused to be

inflated by inflation of the pressure hose to deliver or remove a fluid medium into or from the discrete mass.

The pressure hose and/or the fluid delivery hose may be so-called 'lay-flat' hoses. The fluid delivery hose may be perforated or may be fluid permeable along its length. The fluid delivery hose may be protected by a covering, e.g. in the form of a sock, of a geotextile material.

The pressure hose may be positioned inside the fluid delivery hose. More than one pressure hose may be positioned inside the fluid delivery hose to cause inflation of the delivery hose on inflation of the pressure hoses. The pressure hoses may comprise an opposed pair of relatively large diameter hoses separated by a relatively small diameter hose.

The pressure at fluid delivery hoses may be protected by positioning them between parallel rigid rails, e.g. of metal, which thus form a channel in which the hoses are positioned.

BRIEF DESCRIPTION OF DRAWINGS

The invention is diagrammatically illustrated, by way of example in the accompanying drawing which is a cross-sectional view of an embodiment of the invention.

In the drawing there is shown apparatus 1 for transporting air to a composting heap, not shown, arranged on a floor 2. The apparatus comprises an inflatable pressure hose 3 disposed inside an inflatable fluid delivery hose 4 of the "lay flat" kind. The hose 4 is

protected by a covering 5 in the form of a sock of geotextile material.

A parallel pair of rigid metal rails 6 of triangular cross-section are disposed closely adjacent to the opposed sides of the hose 4 to protect the hose from damage if run over by a heavy vehicle such as a self propelled loading shovel. The rails are positioned sufficiently closely to ensure that the wheels of the loading shovel straddle the two rails which bear the weight of the loading shovel.

The method of the invention may comprise the following steps: -

1. A series of the pressure hoses are laid on the floor in the area on which the material to be treated is to be stacked or heaped, and the delivery hoses are positioned inside or in the immediate vicinity of the pressure hoses.
2. The material to be treated is placed over the hoses. At this time the hoses will generally lie flat on the floor and will not be under pressure.
3. The pressure hoses will then be inflated using gas or liquid. In the course of the inflation under pressure the pressure hoses will displace material in their immediate area.
4. After the pressure hoses have remained under pressure for a period of time, the pressure in the hoses is released. In certain materials this will leave a void or cavity in the material resulting from the material displacement which occurs when the hoses are

pressurised. In this situation, the delivery hoses, which have been placed in the immediate vicinity of the pressure hoses and thus of the void or cavity, are used to deliver or remove the required fluid, i.e. gas, liquid, or vapour.

5. With some materials to be treated, a void or cavity of sufficient integrity will not remain after the release of pressure in the pressure hoses. In this situation, the pressure hoses and the delivery hoses can be positioned in a manner as to allow the pressure to be maintained within the pressure hoses, see below, and by doing so a secondary void or cavity area is created. The void or cavity created by the pressure hoses is then used by the delivery hoses for the distribution or removal of the required fluid at low pressure. A hybrid approach is also possible where the pressure hoses are pressurised and then deflated on a cyclical basis to re-open and maintain a void or cavity.

6. After the material has been treated both the pressure and delivery hose are allowed to become completely deflated. In this condition they may either be removed from beneath the heap of material by pulling from one end, or left on the floor and the material removed from above them. As the hoses have flexible walls, both of these options are practical. In the first instance because they occupy a smaller void space in the deflated state and therefore the frictional

resistance is lower, or secondly, they lay flat on the floor and material handling vehicles can operate over the hoses without crushing the profile of the hoses.

The advantages of the arrangement described above include:-

1. The use of flexible wall hose rather than rigid wall pipe enables material handling equipment, such as front end loading shovels, to drive over the hose during loading and unloading without permanently crushing the hose.

2. By using flexible wall hose it is possible to withdraw the hose from the material with less friction than would be present if rigid wall pipe was used. This is due to the fact that the flexible hose, when deflated, occupies a smaller cross sectional area than its rigid wall equivalent pipe. This means that the contact between the wall of the hose and the material surrounding it likely to be lower and hence the friction will be lower.

3. The flexible wall of the distribution hose moves during inflation and one of the effects of this is to dislodge material which can become held within the discharge holes in the hose. This makes the holes less susceptible to blockage. This is a significant advantage over the alternative methods of distribution in similar circumstances, e.g. holes in rigid wall pipe or holes in in-floor channels.

4. Flexible wall hose is lower in volume when collapsed

than comparable rigid wall pipe and this makes it easier to transport and install.

5. The flexible wall hose system is both cheaper and quicker to install than in-floor ducts with perforated tops.

6. The flexible wall hose system has the advantage over an in-floor channel system that it will not flood when the material overlying the channel is draining liquids.

7. The flexible wall hose system can be installed on existing surfaces without further modifications such as in-floor ducting.

The pressure normally used in the high pressure hose is between 100 and 400kPa normally 200kPa. This pressure is delivered by means of a piston compressor similar to those used to inflate car tyres etc. The low pressure air delivery hose is fed by means of a centrifugal fan and the maximum pressure usually found in this pipe is 2.4kPa. This hose is perforated and the size and number of holes affects the flow out of the distribution hose. The geotextile hose is porous and is used to protect the inner hose from punctures caused by stones being compressed between the floor and the inner hose or the inner hose and the tyres of the loading shovels.

The metal protection rails run along the entire length of the hoses and act as a load bearing structure which carries the weight of the loading shovel as the shovel moves over the hoses. This distance between the rails is

close enough to ensure that the shovel tyre straddles the two rails

Both the metal protection rails and the geotextile sock are optional as they serve only to give protection to the system rather than being an integral part of the operation of the system.

The invention thus provides a simple and effective method and means for delivering fluids to a discrete mass.

CLAIMS

1. A method of transporting a fluid medium to or from a discrete mass supported on a floor, comprising arranging an inflatable pressure hose or pipe under the discrete mass, arranging an inflatable fluid delivery hose or pipe to lie adjacent to the inflatable pressure hose, inflating the pressure hose to form a cavity in the discrete mass such that the delivery hose is at least partly in the cavity and supplying fluid medium to the delivery hose whereby the fluid medium is introduced into the discrete mass, or alternatively evacuating fluid from the mass *via* the delivery hose.

2. A method according to claim 1, wherein the pressure hose is arranged on the floor.

3. A method according to claim 2, wherein the pressure hose and the delivery hose are first positioned on the floor in a deflated condition and the discrete mass is placed on the hoses while they are deflated.

4. A method according to any preceding claim, wherein the pressure hose is inflated to a high pressure e.g. of the order of 100 to 400kPa.

5. A method according to any preceding claim wherein the delivery hose is inflated to a pressure in the range 0.5 to 2.4kPa.

6. A method according to any preceding claim, wherein the pressure in the pressure hose is released after creation of the cavity so that the pressure hose deflates.

7. A method according to any preceding claim, wherein the

fluid medium is gaseous, e.g. air.

8. Apparatus supplying a fluid medium into, or removing fluid from, a discrete mass supported on a floor, comprising an inflatable pressure hose under or in the discrete mass, and an inflatable fluid delivery hose positioned adjacent to the inflatable pressure hose, the arrangement being such that the pressure hose can be inflated to create a cavity in the discrete mass and such that the fluid delivery hose can be inflated in the said cavity or is caused to be inflated by inflation of the pressure hose to deliver or remove a fluid medium into or from the discrete mass.

9. Apparatus according to claim 8, wherein the pressure hose and/or the fluid delivery hose is a so-called 'lay-flat' hose.

10. Apparatus according to claim 8 or 9 wherein the fluid delivery hose is perforated or fluid permeable along its length.

11. Apparatus according to any one claims 8 to 10, wherein the pressure hose is positioned inside the fluid delivery hose.

12. Apparatus according to claim 11 comprising more than one pressure hose positioned inside the fluid delivery hose to cause inflation of the delivery hose on inflation of the pressure hoses.

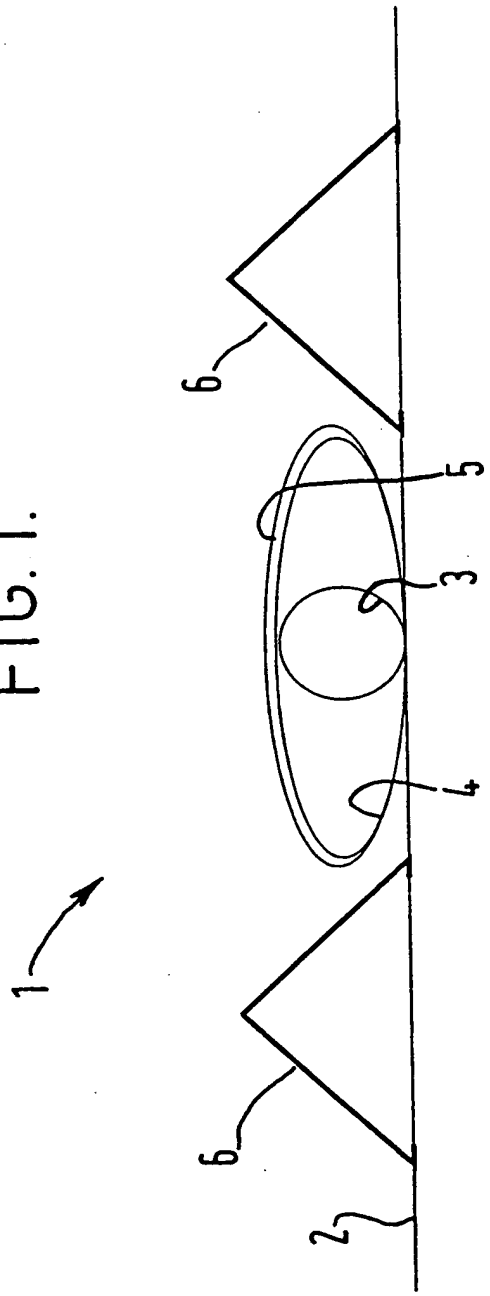
13. Apparatus according to claim 12, wherein the pressure hoses comprise an opposed pair of relatively large diameter hoses separated by a relatively small diameter hose.

14. Apparatus according to any one of claims 8 to 13, wherein the fluid delivery hose is protected by a covering of geotextile material.

15. Apparatus according to claim 14, wherein the protective covering is in the form of a sock.

16. Apparatus according to any one of claims 8 to 15, wherein the pressure and fluid delivery hoses are positioned between an adjacent parallel pair of rigid rails laid on the floor.

FIG. 1.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/02728

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F26B9/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	EP 0 835 856 A (THOENI INDUSTRIEBETRIEBE GES M) 15 April 1998 (1998-04-15) cited in the application the whole document	14,15 1,2,7,8,10
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A	US 2 502 205 A (COLLINS ET AL) 28 March 1950 (1950-03-28)	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 November 2000	16/11/2000

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

information on patent family members

Inte onal Application No
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